CLAIM AMENDMENT

1. (Original) A quantum gate comprising two waveguides, an input section of at least one of the waveguides leading to a coupling region where the two waveguides are coupled, an output section of each of the waveguides leading from the coupling region to an output end of the waveguide, and at least one bias element operative to apply one of an electrical and magnetic bias to the gate to cause carriers moving through the input section of the at least one waveguide into the coupling region to be coupled to one or the other of the output sections of the waveguides in dependence on application of the bias.

2. (Original) The quantum gate of claim 1, wherein the coupling region is a tunneling region for passing carriers from the at least one waveguide to the other waveguide by tunneling.

3. (Original) The quantum gate of either claim 1 or 2, wherein the at least one bias element is operative to apply an electrical bias across the gate to force carrier movement across the coupling region from the input section of the at least one waveguide to one or the other of the output sections.

4. (Original) The quantum gate of either claim 1 or 2, wherein the at least one bias element is operative to apply a magnetic bias to the gate to force carrier movement across the coupling region from the input of the at least one waveguide to one or the other of the output sections.

5. (Original) The quantum gate of claim 4, wherein the bias element is a conductor proximate the coupling region.

6. (Original) The quantum gate of either claim 1 or 2, wherein the waveguides and the coupling region are a part of a semiconductor structure.

7. (Original) The quantum gate of claim 6, the semiconductor structure being of a InAs/InGaAs heterostructure.

8. (Original) The quantum gate of either claim 1 or 2, wherein the at least one waveguide is of substantially uniform width and the other waveguide has an output region that is wider than the width of the at least one waveguide.

9. (Original) The quantum gate of claim 8, wherein the other waveguide has an input region leading to the coupling region that is narrower than the output region of that waveguide.

10. (Original) The quantum gate of either claim 1 or 2, wherein the coupling region is 300 to 450 nm in length.

11. (Original) The quantum gate of claim 10, wherein the waveguides are 20 to 50 nm in width.

12. (Original) The quantum gate of either claim 1 or 2, wherein the waveguides are separated by a potential barrier at locations other than the coupling region.

13. (Original) The quantum gate of claim 9, wherein the input and output regions of the waveguides are separated by a potential barrier.

14. (Original) The quantum gate of claim 12, wherein the potential barriers comprise deposited conductors.

15. (Original) The quantum gate of claim 12, further comprising potential barriers defining edges of the waveguides spaced from the potential barriers separating the waveguides.

16. (Original) The quantum gate of claim 15, wherein the potential barriers comprise deposited conductors.

17. (Original) The quantum gate of 13, further comprising potential barriers defining edges

of the waveguides spaced from the potential barriers separating the waveguides.

18. (Original) The quantum gate of claim 17, wherein the potential barriers comprise deposited conductors.

19. (Original) The quantum gate of either claim 1 or 2, further comprising means associated with the input region of the at least one waveguide operative to modify a quantum characteristic of charge carriers moving in that input region towards the coupling region.

20. (Original) The quantum gate of claim 19, wherein the quantum characteristic is electron spin, whereby carriers moving in the input region of the at least waveguide are selectively electron spin polarized by operation of the means to modify a quantum characteristic.

21. (Original) The quantum gate of claim 19, wherein the quantum characteristic is electron spin and wherein the means to modify a quantum characteristic is a quantum point contact (QPC) and a source of magnetic field associated with the input region of the at least one waveguide.

22. (Original) The quantum gate of either claim 1 or 2, further comprising a quantum point contact and a source of magnetic field associated with the input region of the at least one waveguide operative selectively to effect electron spin polarization of carriers moving in that input region.

23. (Original) The quantum gate of either claim 1 or 2, wherein the charge carriers are electrons.

24. (Original) The quantum gate of either claim 1 or 2, wherein the waveguides are defined by deposited metal conductors operative to develop potential barriers in a semiconductor substrate on which they are deposited and in which the charge carriers move.

25-34. (Canceled)

35. (Original) A semiconductor waveguide gate device comprising:

(a) a first waveguide boundary,

(b) a second waveguide boundary spaced from and substantially parallel to the first waveguide boundary,

(c) a first metallic member defining a first waveguide separating boundary protruding between the first waveguide boundary and the second waveguide boundary,

(d) a second metallic member defining a second waveguide separating boundary protruding towards the first electrode between the first waveguide boundary and the second waveguide boundary,

(e) each of the first and second metallic members having edges facing the first waveguide boundary to define a potential barrier spaced substantially the same distance a from the first waveguide boundary,

(f) each of the first and second metallic members having a further edge facing the second waveguide boundary,

(i) the further edge of the first metallic member being spaced from the second waveguide boundary to produce a potential barrier a distance b from the second waveguide boundary,

(ii) the further edge of the second metallic member being spaced from the second waveguide to produce a potential barrier a distance c from the second waveguide boundary that is greater than a,

(iii) the further potential barriers of the first and second metallic members forming with the second waveguide boundary a second waveguide along the second waveguide boundary,

(g) the first and second metallic members having ends separated by a coupling, and

(h) bias applying means located to selectively apply one of a magnetic and an electrical bias to charged particles moving in the first and second waveguides.

36-38. (Canceled)

39. (Original) A method of transistor quantum gate operation comprising:

(a) providing in a semiconductor substrate a first waveguide,

(b) providing in the semiconductor substrate a second waveguide,

(c) providing a coupling between the first and the second waveguide,

(d) moving a charge carrier current in one of the waveguides, and

(e) selectively controlling the path of electron current to one or the other of outputs of the waveguides by applying at least one of an electrical and a magnetic bias to the electron current to cause tunneling of the current in the coupling.

40. (Original) The method of transistor quantum gate operation according to claim 39, wherein steps (a) and (b) comprise developing barrier potentials in the substrate to define the waveguides.

41. (Original) The method of transistor quantum gate operation according to claim 40, wherein developing the barrier potentials comprises:

(i) developing a first barrier potential separating the waveguides at their input ends between inputs to the waveguides and the coupling, and

(ii) developing a second barrier potential separating the waveguides at their output ends between outputs from the waveguides and the coupling.

42. (Original) The method of transistor quantum gate operation according to claim 41, wherein developing the first and second barrier potentials comprises defining one waveguide that is wider at its output end than width of the other waveguide at its input end.

43. (Original) The method of transistor quantum gate operation according to claim 39, further comprising selectively polarizing the electron spin of charge carriers moved in one of the waveguides.

44-53. (Canceled)